Evolution of magnetic field turbulence as observed by the Voyagers in the heliosheath and in the local interstellar medium

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Evolution of magnetic field turbulence as observed by the Voyagers in the heliosheath and in the local interstellar medium.

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Abstract Text:

Voyager 1 (V1) left the heliosheath (HS) and entered the Local Interstellar Medium (LISM) in August 2012. At the same time, Voyager 2 (V2) was inside the HS and it is currently approaching the heliopause. The nature of the mainly compressive and “turbulent” fluctuations observed in the HS and in the LISM is still unclear.

The presented study aims at describing the spatial and temporal evolution of turbulence in the HS and in the LISM. It shows a collection of power spectra of magnetic field fluctuations computed from consecutive periods since 2009. Unlike previous analysis, the highest resolution data (48 s) available are used to observe up to five frequency decades. Proper spectral recovery techniques applied in a previous work [Gallana et al, JGR 2016] are exploited to overcome the problem of missing data. Inside the HS, the achieved results are consistent with an anisotropic, mainly inertial, energy cascade in the frequency range [10^{-5},$5{\cdot}10^{-4}$] Hz, with spectral index ranging from -1.65 (V2) to -2 (V1) and energy spectral transfer around 10^{-19} erg/(cm^{3}s). Anisotropy is significantly higher at V1 than at V2. In 2009 and 2010, tangential magnetic field fluctuations at V1 contain half of the fluctuating magnetic energy, which is not observed at V2. Large scales prior to the spectral break ($f<10^{-5}$ Hz) are featured by a mild spectral decay with index between -0.95 and -1.5. Observations of small scales ($5{\cdot}10^{-4}<f<10^{-2}$ Hz) are limited by the onboard magnetometer’s accuracy, though some kinetic effects are

still visible. LISM spectra in 2013.36 - 2014.65 are in agreement with previous observations [Burlaga, Florinski & Ness ApJ Lett, 2015]. A slightly flatter spectral trend than the Kolmogorov's is observed for the radial fluctuations at [10^{-7}, 10^{-6}] Hz. However, the tangential and normal components show nearly a f^{-1} decay. The evolution of turbulent spectra in the LISM is investigated.

Session Selection:
Physical Phenomena in the Outer Heliosphere and Beyond

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Previously Published Material:
Some findings have been reported in Federico Fraternale's PhD thesis (2017, under evaluation).

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